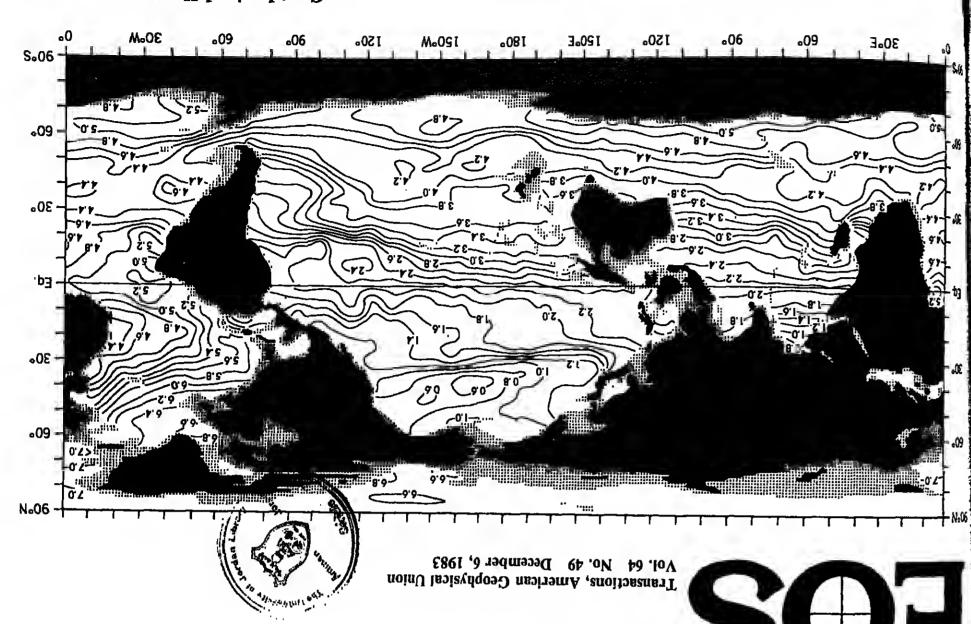
Geophysical Year, page 970



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December 6, 1983

Social Sciences

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Water Resour. Res., Paper 3W1861

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Tectonophysics

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B. H. Page (Depertamen of Gaology, Stanford University,
Scanford, California 94305), end D. C. Engabracion

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DEFORMATION OF THE NUTAIA REGISTS:

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Genesis of the International Geophysical Year

James A. Van Allen Department of Physics and Astronomy, University of Jowa, Iowa City, IA 52242

Editor's Note: The following article is taken from a speech prepared at the invitation of David Stem, chairman of the AGU Committee on the History of Geophysics, and delivered at the 1982 AGU Fell Meeting in Snn Francisco.

Introduction

The plan for a third International Polar Year, later broadened in scope and renamed the International Geophysical Year 1957-1958, originated on April 5, 1950, at a small dinner party of geophysicists at my home at 1105 Meurilee Lane, Silver Spring, Maryland, The basic concept was put forward by Lloyd V. Berkner. He and Sydney Chapman were principally responsible for developing and enlarging the concept to a persuasive level of dead and potential implementation, with the help of suggestions by others present: Ernest H. Vestine, J. Wallace Joyce, S. Fred Singer, my wife, Abigail, and myself. I will give a brief account of the context within which this meeting occurred and of the evening's discus-

First, I will make a few remarks on the circomstances that led to this occasion, begin-ning with a quotation from an article by Sydpey Chapman in Nature, August 22, 1953;

"In 1882-83, many nations joined in a great imernational scientific enterprise, the International Polar Year, in which the geophysics of the polar regions—mainly the Arc-tic-was intensively studied, and expeditions se up polar meteorological, magnetic anil attreral stations and operated them for twelve orthineen months. In 1982-33 the jubilee of this First Polar Year was celebrated by a repethen and extension of the enterprise, and imospheric observations were included in the

Ian among the few persons here today shoparticipated in the secund International Post Year (IPY) on, indeed, have any personal knowledge of it. My participation was impression on me.

folkning my freshman year at Iowa Wes-kan College, I spent the summer and au-

James A. Van Allen, predent of AGU and pro-few of physics and head of the Department of Phys-us and Astronomy at the University of lower, is the mighent of numerous re- work awards and honors.

His interests include murleor physics, ballistics, cosmic radiation, terrestrial magwhen, magnetospheric physics, salar-energetic par-fels, solat X mys, interplanetary medium, and Hardary magnetuspheres.

tunn of 1932 helping Thomas C. Poulter, the professur of physics there prepare geo-physical equipment for the second Byrd Ant-arctic expedition. This expedition was to have been a part of 1PV 11, though it actually oc-curred about 2 years later, in 1934-1935. My jobs were testing reticles for the observation of metenr trails, a seismograph and a porta-ble magnetomerer of the Department of Ter-restrial Magnetism (DTM) of the Carnegie Institution of Washington. This magnetometer was the most heautiful instrument that I have ever used. With the help of Daniel L. Hazard's Directions for Magnetic Measurements, a 1930 publication of the U.S. Coast and Geodetic Survey, I learned how to use the magnetometer and its associated theodolite and made a magnetic field survey of Henry County, lows. I then sent my observations to John A. Fleming, director of DTM, for inclusion in the national grid of 1932.

Seven years later, I went to DTM as a postdoctoral research associate. My own work there was in Merle Trive's nuclear physics laboratory, but I also got acquainted with a wide spectrum of geophysicists on the staff: John Fleming, Scott Furbush, Alvin McNish, Harry Vestine, Bill Rooney, and others. In addition, the European geophysicists Sydney Chapman and Julius Bartels were occasional visitors to DTM during the course of the preparation of their great, twn-volume treatise on Geomagnetun

After World War II, I organized a research group at the Applied Physics Laboratory (APL) of Johns Hopkins University, using V-2 and Acrubee rorkers for high-altitude scientific measurements. Harry Vestine, who had been a Ph.D. smilent of Chapman's at Oxford University, urged us to undertake a search for the equatorial electrojet that Chap-man and he had inferred from ground-based magnetometer reunils. The basic idea was to fly a magnetometer directly through the electrojet, thought to be in the E laver of the innosphere at an abituale of about 100 km, and to determine the altitude distribution of the density of electrical current front its magnetic

The most promising instrument for this purpose was a three-axis lluxgate magnetonieter of the type that was in use at the Naval Ordinance Laburatory (NOL). By arrangement with L. R. Maxwell and Leroy Allthrealge, Elward Maple and W. A. Buwen of NOL undertook the slevelopment of a sub-able small min and S. Fred Singer, L. W. Fraser, and I, of APL, adapted it for flight as part of the payload of an Aerobee rocket. The lirst juron llight of the system was made at the White Sands Proving Ground in New Mexico on April 13, 1948, to an altitude of 113 km ubove sea level. Cood measurements were obtained throughout the flight but, as expected, the principal finding was that the field strength obeyed the inverse cube law.

The next stage of the investigation consisted of three Aerobee flights near the magnetic equator off the coast of Peru from the USS Norton Sound in Murch 1949. This expedition

provided the first U.S. flights of high-altitude sounding rockets at any location other than White Sands. Two of these flights, carrying NOL magnetnmeters and APL cosmic ray equipment, were successful, reaching altitudes of 105 km. One of the magnetometer records, the one taken at the project local time, yielded a convincing signature of at least a partial penetration of the electrojet i the altitude range 93 to 105 km. The report of the results by Singer. Maple, and Bowen may be found in *Journal of Geophysical Research*, 56, 265, 1951. We made further Aerobee flights of cosmic ray equipment in the Gulf of Alaska in January 1950.

The Dinner

Vestine was delighted with our equatorial electrojet results, as was Chapman who was visiting the United States in early April 1950. On April 5 they visited APL in order to learn about the results at first hand. Chapman expressed an interest in getting together with us and with Lloyd Berkner and Wally Joyce for further discussions. I immediately called my wife to confirm a previously tentative plan that she would have the group for dinner at our hume. During the day she cleaned the house, prepared a splendid dinner, and managed to feed nor two young ilaughters and turk them into bed as the guests arrived.

The orcasion turned out to be one of the most felicitors and inspiring that I have ever experienced. Berkner was one of the leading expens on ionospheric physics and telerom-munications at that time, had been a member of the scientific staff of the first Byrd Antarctic Expedition in 1928-1930, and had extensive experience in international rouperation in science while a member of the U.S. State Department, Javec was a distinguished geo magnetirian who had published the wellknown Manual of Geophysical Prospecting with the Magnetoweter in 1937 and was, as I recall, on the staff of the National Research Council

The dinner conversation ranged widely over grouphysics and especially genuaguetism and ionospheric physics. Following climer, as we were all sipping brandy in the living toom, Berkner inflied to Chaoman and said, "Sydney, don't you think that it is about time for another integrational point year?" Chapman immediately embraced the suggestion, remarking that he had been thinking along the same lines hiniself. The conversation was then directed to the scope of the enterprise and to practical ronsiderations of how to contact leading individuals in a wide range of international organizations in order to culist their support. The year 1957-1958, the 25th anniversary of the second polar year and one of anticipated maximum solar activity, was se-lected. By the close of the evening Chapman, Berkner, and Joyce lad agreed on the strategy for proceeding.

The occasion is described in Chapman's

words as follows, also from his 1953 Nature

On April 5, 1950, Dr. L. V. Berkner, at a small gathering of geophysicists at the then home of Prof. J. A. Van Allen, Silver Spring, Maryland, U.S.A., proposed a sec-ond repetition after twenty-five years in-stead of fifty years, in view of the rapid advances made since 1933 in scientific, especially innospheric, techniques. Being favourably regarded, this proposal was forinally brought before three international scientific hodies in the summer of 1950the lirst to need was the Mixed Commission on the lonosphere (MCI), formed by the International Council of Scientific Unions (ICSU) under the sponsorship of the International Union for Scientific Radio (URSI) with the co-nperation of the International Astronomical Union (IAU) and the International Union for Geodesy and Geophysics (UGGI). The Mixed Commission on the lonosphere presented the proposul in some detail to the International Council of Scientific Unions, and recommended the formation of a committee to organize a third polar year in 1957-58."

The remainder of Chapman's paper gives eloquent testimony to the vigor and sagacity with which the matter was pursued.

JGR Papers on LAGEOS

AGU is hivining contributions to a spe-cial issue of the Journal of Geophysical Re-tearch (JGR) devoted to the results from analyses of faser Goodynamics Satellite (LAGEOS), Examples of topics appropriate for the issue include, but are not fintil

(1) Geodesy: gravity held, intersite baseline distances, polar motion, earth titles, and satellite orbit perturbations (2) Tectoriophysics: tectoric idate motion, crustal delormation, gravity and geoid interpretation, and mantle convention,

itructine, and rheology (3) Solid earth-ocean-atmosphere inter-

All analyses should be based on LAGEOS data or make extensive use of LAGFOS data along with other information. Peer review of all papers will be inaccord with the usual JGR standards. Pa-pers, in the standard AGU manuscript format, should be received by editors no later than February 29, 1984.

Seml one copy to:

Guest Editor, LAGEOS Special Issue Geodynamics Branch, Code 921 Goddard Space Flight Center Greenhelt, MD 20771

Send four copies to:

Gerald Schubert

Ellitor, Journal of Geophysical Research Department of Earth and Space Sci-

University of California, Los Augeles Los Angeles, CA 90024

Amhors should artyise Cohen by December 31, 1983, of their intention to make a contribution. He can be reached a the above address or by telephone at 301-

Fossil Records of Volcanism

Greenland glacial ice contains a fossil re-tord of volcanic emissions transported in the aratosphere, C. V. Hannmer, H. B. Clausen and W. Dansgaard (Nature, 288, 290, 1980) and M. W. Herron (Journal of Geophysical Re-land, 87, 3052, 1982) unted peaks of relafiely high acidity in the Greenland glacial ningraphic record that are assumed to be due to precipitation of sulfuric acid aerosols der major volcanic eruptions. R. B. Stothers tity in the period 1300 B.C. to A.D. 1500 with dated acid maxima in Greenland ice (Scimar, 222, 411-412, 1983).

Stothers and Rampino's soon-to-be-reported tearch (Journal of Geophysical Research, in pess) included examination of "about one quater of a million pages of modern English ten" (Stience). In their analysis they took into acount the statistical uncertainty of the iceore dates and the time lags that would be ex-pend to delay the arrival of acid rain from disant European volcano sources. Of course the problem of the analysis is that whereas there are constant analysis of European volthere are extensive records of European voland, there is precious little information on wheato activity that must have occurred during the tame period in the western Pacific and in the western hemisphere. Beginning

at about 1390 B.C. (± 50, by radiocarbon methods), Stothers and Rampino correlate historical data through Yesuvius (217-216 B.C), Etna (44 B.C.), and others. There seems to be an acid peak to correlate in each instance in the data of Hammer et al.

The problem of ignoring other northern hemisphere volcanism was argued on the basis of the known (or deduced) sulfur/silica ratios of die volcanic eruptions, substantiated in part by the historic record of the occurrence of so called "dry fogs." Dry fogs were atmospheric liazes produced by volcanic emissions probably containing high sulfur concentrations. Stothers and Rampino conclude that and M. R. Rampino of the Goddard Institute their library searches and analyses of correlations. for Space Studies in New York recently did a tions "indicates that European volcanic erup earch of historical records and found an unexpected correlation of European volcano acduring the past 3500 years." The next step will be to attempt a correlation between the historical acid aerosols in the atmosphere and climate.—PMB

Fighting Wind Shear

A "coherent and sustained program" of improved radar detection of weather, pilot training, and better communication between pilots and air controllers can greatly reduce the risk of wind shear to airplanes landing or

New Orleans International Airport, which killed 153 persons. Following the accident, Congress directed the Federal Aviation Administration (FAA) to contract with the NRC to study wind shear.

Some wind shears, such as those associated with warm and cold fronts, low-level jet streams, and mountains, have been understood and predicted for years. However, meteorologists have only recently identified one of the most treacherous types of wind shear: ing a thunderstorm, that spreads out in all directions once it strikes the earth. What makes this type of wind shear even more hazardous is that it is usually small and localized and . therefore difficult to predict. The quickest way to reduce the risks associ-

ated with such wind shear is to impress upon pllots the prudence of avoiding weather con-ditions conducive to wind shear and to instruct them in more effective ways to handle their aircraft if they cannot avoid them. How ever, the NRC committee also recommended that the technology used to predict the wind shear be improved. In the near term, the Low-Level Wind Shear Alert System (LLWSAS) should be improved and expand-ed, the NRC committee said; in the longer term, an advanced warning system needs to be developed. (See Eas, February 15, 1983, p. 67, for a discussion of solltary atmospheric. waves as a source of wind skear.)

Currently, LLWSAS, which is a systept of pund-level sensors that measure wind veocity at or near airports, operates at 59 ma-

proved and that the improved versions be installed at all high-density airports where wind shear is likely to occur.

A combination of new technologies would

comprise the advanced warning system envisioned by the NRC committee. NEXRAD, the next-generation nationivide weather network that uses pulsed Doppler radar, would be a part of that technology package. Each radar, with a range of up to 320 km, would be able to identify conditions that could give rise in wind shears, but would not provide the min ute-to-minute observations required to detect and locate hazardous wind shears near an airport. To provide this sort of monitoring, the NRC committee urged the FAA to "aggressively support" the development of a Doppler radar system specifically designed for this purpose, but warned that such development t not interfere with the development of NEXRAD."

DPEP in Geochemistry

According to a group of Investigators at the CSIRO Lucas Heights Research Laboratories, New South Waies, the otetal porphyrio DPEP (if it can be proved to exist) plays a key role in theories of the organic origin of petro-letum. The proof would involve a single crys-tal structure determination of the lunge molecule isolated from a geological sample and this is what the CSIRO group successfully achieved (Nature, 306, pp. 173-174, 1985). About 50 years ago A. Treibs postulated that vanadyl-DPEP is the dominant metal-or-

News (cont. on b. 978)

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then 1450 B.C. (the voica no date having changing direction and speed, has caused several determined from "archeology and leg the most notable is the july 8, 1988; crash of the most notable is the most about 1450 B.C. (the volcano date having ben determined from "archeology and leg-

taking off, according to a National Research
Council (NRC) committee.
Wind shear, characterized by winds rapidly

jor U.S. airports. The FAA has scheduled the installation of the system at 51 additional airinstallation of the system at a Fadditional air-ports by 1985. The NRC countities recom-mended in its report Low-Alltide Wind Shear and In Hazard to Aviation that LLWSAS be im-

(大声は、東京の表現を記録を記録を知るからなり、自由を含むしませんというは、養育度は

News (ront. from p. 977)

ganic compnued in crude oils and oil shales. but until this recent study, existence of the compound has remained incumfirmed. Treibs' scheme detailed the formation of the porphyrin from chlorophyll. The steps of prophyrin furnation could characterize the biological origin of petroleum, but the very crucial plece of evidence has been lacking.

The apparent difficulties of extracting an adequate single crystal without suffering chemical decomposition were uvercome in a multistep process. The extraction was accomplished with a sample of oil shale from the Julia Greek Deposit in North Queensland, Australia. X ray diffraction analysis yielded a monoclinic cell (P2s) with $a = 12.912 \pm (3)$, b = $14.151 \pm (4)$, and $c = 18.404 \pm (8)$, $\beta =$ 70.34 ± (2). The structure refinement completed with a residual of 0.077. The crystals were found to have the vanadyl Cs2 DPEP structure, which was proposed by Treibs in

According to the CS1RO group: "The result is important because it represents the first complete identification of a petroporphyrin unlikely to have been eliemically altered by the extraction procedure, More importantly, however, the determination of this structure confirms, for the first time, the long-held belief that petroporphyrins are derived from chlurophyll." The results substantiate Treibs' hypothesis, which is accepted as the foundation for organic geochemistry.-

Artificial Coal

The geology and geochemistry of coal nee receiving increased attention in feileral government laboraturies. Goal may be burned at Increasing rates for centuries to come, and thus its properties must be better known. A new approach to coal research was reported recently by investigators at the Argonne National Laboratory (Chemical and Engineering News, November 21, 1988). A group from Argonie's Division of Chemistry Iras recently synthesized coal from natural materials. The results of this study may provide insight to the nature of the highly complex organic structures that are found in coal. Clearly, the goals of the Argunne program to characterize coal chemically and to tlocument the geological processes of its formation are closer to be-

ing realized than ever before. There may be numerous geologic processes involved in the formation of coal deposits. Plant material is illought to undergo bioge netic alteration in nature before it is metamorphosed into coal, but the new Argonne results may dispute this. In the artificial coalification experiments, lignin was converted directly to lignite by a clay-catalyzed process. The geological analoguse would be the slight alteration of wood, with the loss of hydrocarbons, followed by the formation of coal macromolecules at relatively low temperatures (150 "-200"). Natural clays could aci also to catalyze the reaction

The study is only beginning, but the early findings have been intriguing samples of what may be expected. The suggestion is that lignins and other similar materials may survive sedimentary diagenetic processes; in-deed, diev may be relatively pure products. If so, they could be converted directly to coal molecules in relatively short time periods (months) by naturally eatalyzed reactions.—

Hubble Space Telescope

The Space Telescope, scheduled for launch aboard the Space Shuttle in 1986, has been renamed the Edwin P. Hubble Space Telescope, the National Aeronautics and Space Administration (NASA) artnounced. The orbising optical astronomical observatory will carry a 2.4-m mirror and five scientific instruments that will be able to look into space 7 times farther than any ground-based observatory; NASA espects the resolution of the resulting linages to be 10-20 times better

than images from ground-based instruments.
Hubble probably is best known for his discovery, with colleague Milton Humason, that the universe is expanding. Hubble confirmed that the faint, spiral nebulae viewed through the Mount Wilson Observatory's Hooker Telescope were slistant systems receding from us nt vehicities proportional to their distances. Hubble was n staff mesuber in Carnegie Institutinn's Muunt Wilson Observatory near Pasadena, Calif., from 1919 until his death in

Geophysicists

Charles A. Barth, director of the Laboratory fur Atmospheric and Space Physics at the University of Colorado, Boulder, recently was awarded the National Aeronautics and Space Admirastration's medal for distinguished public service. Barth was cited for his "outstanding leadership and contributions in proposing and establishing the Solar Mesosphere Explorer [SME] project" as well as his personal declication that has helped make the SME a "highly successful scientific mission."

OPO

Recent Ph.D.'s

cepted doctoral dissertations in the disciplines of grophysics. Faculty members are invited to submit the following information for publication, on institution letterhead, above the signature of the faculty advisor or department chairman:

(1) the dissertation title (2) author's name (5) name of the degree-granting department and

(4) month and year degree was awarded. If possible include the current address and telephone munber of the degree recipient (this information will not be published).

Roch Alagnetism and Poleomagnetism of Aliocence Fluviol Sediments in Northern Pahistan, Lisa Tauxe, Dept. of Geological Sciences, Co-

lumbia Univ., January 1983. Seismic Hazards Evaluation in Interplate and In Iraplate Environments, Smart P. Nishenko, Dept. of Geological Sciences, Columbia , January 1983.

Seismic Velocities and Attenuation in o Hented Underground Granitic Repository, Bjorn N. P. Paulsson, Dept. of Materials Science and Mineral Engineering, Engineering Geosri-ence, Univ. of California, Berkeley, Janu-

Geochemistry of Haleahala Volcono, East Maui, Hawaii and Implications for the Evolution of Hawaiian Volcanos, Ghu-Yung Ghen, Dept of Earth, Atmo- spheric and Planetary Sciences, MIT, February 1983.

High Temperature Deformation of Hot-Pressed Polycrystalhuc Orthografatite, A. Delighan, Dent. of Materials Science, Univ. of South em California, February 1983.

Energitation of Ions by Oblique Double Layers, Marian Elizabeth Greenspan, Physics Dept., Univ. of Galifornia, San Diego, April 1983. Geologicolty-Developed Probability Seismic Risk Anothin, Huh-Yuan Liang, Dept. of Geological Engineering, School of Mines & Metallurgy, Univ. of Missouri-Rolla, May

High Latitude Field Currents, Janke L. Karty. Dept. of Space Physics and Astronomy, Rice Univ., May 1983.

Reliability, Resilience and Vulnerability in Reservoir Operation, Wai-See Moy, Dept. of Geography and Environmental Engineering, Johns Hopkins Univ., May 1983. motectonics of British Columbia, Garry G.

Rogers, Dept. of Geophysics and Astronomy, Univ. of British Columbia, May 1983. Theoretical and Field Studies of Fluid Flou in Fractured Rocks, Paul Anthony Hsieh, Dept.

of Hydrology and Water Resources, Univ. The Thermomechanical Properties of the Convinen lal Lithosphere, Garry D. Karner, Oept. of Geological Sciences, Columbia Univ., May

Grochemistry of Boninites and Other Low TiO: 14-land Are Volcanic Rocks, Rosemary L. Hickey, Depi. of Earth, Atmospheric and Planetary Sciences, MIT, June 1983. Geochemistry of the Presion Cabbra of Southeast Connecticut, Alfred T. Walker It I, Dept. of Geological Sciences, Lehigh Univ., June

Laborotory and Field Investigations of the Proresses Controlling Gas Exchange Acress the Air-Woler Interface, Blayne A. Hartman, Dept. of Geological Sciences, Univ. of Southern Cal-

ifornia, June 1983. Petrochemical Evolution of High Cascade Volcanic Rocks in the Three Suters Region, Oregon, Scott S. Hughes, Dept. of Geology, Oregon

Reservoir Operating Rules Generated by Deterministic and Stochastic Optimization, Mohammad Karamouz, School of Givil Engineering,

Purdye Univ., June 1985.
230 Th. 238 U Disequilibrium Systematics in Young Vokanic Rocks, Sally Newman, Scripps Institution of Oceanography, Univ. of Galifornia, San Diego, June 1983.

Three-Dimerstional Magnetatelluric Interpretation, Philip E. Wannamker, Geology and Geophysics Dept., Univ. of Utah June 1983.

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Clarkson Gollege, August 1983. Crustal Structure and Scismicity of the Washington Gontinental Margin, J. John Taber, Geo-physics Program, Univ. of Washington,

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Hydrographic Variability in the Western North At-lantic Ocean from the POLYMODE Local Dynamics Experiment, Eric J. Lindstrom,

School of Oceanugraphy, Univ. of Washingion, October 1983.

Singnetustratigraphy of Neogene Quaternary Sima-lik Group Sedsments of the Frans-Indus Salt Ronge, Northwestern Pakistan, Multanmoct Javed Khan, Dept. of Geological Sciences, Columbia Univ., October 1983.

Short-term Forecasting of Municipal Water Use, Roland Steiner, Dept. of Geography and Environmental Engineering, Johns Hopkins Univ., October 1988.

Analysis and Interpretation of Magnetic Anomolia Observed in North-Central California, Johnse L. Huppunen, Dept. of Geophysics, Col. lege of Occamography, Oregon State Unit. November 1983.

The Interaction of Short Gravity Waves with the Gulf Stream, Show-Ming Hwang, Dept. of Marine, Earth, and Atmospheric Science, North Carolina State Univ., December

Books

Deposition of **Atmospheric Pollutants**

H. W. Georgii and J. Pankrath (Eds.), D. Reidel, Boston, ix + 217 pp., 1982, \$37.

Reviewed by L. M. Malet

Deposition of Atmospheric Pollutants, containing the proceedings of a colloquium held at Oberursel/Tannus, FRG, November 9-11, 1981, is divided into three main parts: dry deposition; wet deposition; and deposition on plants and vegetation.

The 20 articles in the volume permit a fair survey of present-day knowledge and will be a useful tool to all working on the topic. Pollution by deposition of either the dry or wet sort is very insidious; its importance only appears in the long range, when its effects are or are almost irreversible. That is why concern was so long in emerging from decision

Two maps reproduced in the contribution by H. W. Georgii (pp. 56 and 57) show the global distribution of the acidity in precipitation thH data since 1972) determined owing to the WMO-BAP-mon network data; they are quite expressive and in a certain way chilling, mainly for Europeaus and, above all, for those living around the Baltic and North seas (pH between 4 and 5). Other graphs given in the same article show no significant trends in "acid rain" between 1972 and 1979. Acidic precipitation should certainly be nne of the main subjects of environmental science in the near future.

Looking at the five articles which deal with dry deposition, it is clear that deposition velocity of particles is the main concern. Three types of approach emerge: (1) tunnel experi-menu; (2) modeling under a certain number of assertions of fact and, unfurramately, a greater number of assumptions; and (3) field

experiments on short or long term. The model of Schmel and Hogson, for instance, which is used in one of the contributions, implies that surface elements should have small roughness heights unly; that particle flux is constant; that particle diffusivity can be determined; that the effect of gravity can be defined; that particle agglomention does not occur; and that particles are completely retained by the surface. All these Ilmitations and conditions are seldom formal altogether in field experiments, which are by far the most complicated and interesting. Nevertheless, the model shows that deposition velocity decreases with increasing reference height, increases with increasing rangliness height, and increases with increasing friction

When comparing results obtained using one or the other of the three methods, it is not astonishing at all that differences of one order of magnitude and even more are found. The field of research in this domain is still quite open; it is evident that systematic, long-term experiments should be made over a variety of terrains and under a variety of meteorological conditions before we come to more realistic conclusions.

Eleven contributions have been included in the wet deposition section of the book; in facmust of their deal widt wet and dry deposition effects on the acidity measured at the surface. In this section, studies are mostly based on long scries of data and, or course. on a rather with regional or urban basis, Wes deposition of sulfate, nitrates, and chlorides is the main subject, but heavy metals, polyclic hydrocarbuns, anil trace elements are also considered. Good information is given about sampling systems, siting, chemical analysis, and statistical variability (namely due to mindrop size, rainfall rate, residence time, mesometeorological contlitions, orographic effects, and so on). Articles are well illustrated with charts, graphs, and tables.

Among die conclusions of these article is the following (C. Perseke, University of Frankfurt/Main, p. 85):

"The measurements of wet deposition emphasize that acid precipitation with increased sulfate and nitrate concentrations occur in heavily polluted areas as well as in less polluted areas. In less polluted areas outside the emission areas the concentrations of the acid substances in rain is reduced by a factor or 2 or 3 only. Furthermore, the wet depusition pattern is mainly determined by the precipitation pattern.

This is of main importance for less pollutions. ed mountain regions which receive high wet deposition of acid substances."

Together, the articles show what should be done all over the world, even in regions which are unt yet concerned or are not yet aware that they are afflicted by pollution

from wet and dry deposition.
The third chapter deals with deposition on plants and vegetation. Out of four contribuions, three are devoted to the deposition of Hic atmospherie acrosol above and beneath a beech and spring towest canopy and its conlogical ellers awing to the serious changes in soil chemistry that are believed to be triggered by acid rain.

The result is a serious degradation of beech and spruce forests which act as acid concentrators. Acid entering the forest ground is 2 (heech) to 4 (spruce) times the acid in the rain entering the forest canopy because foliage and bark capture and oxidise SOs present in the amusphere in very low concentrations. When it rains, this acidity is washed out, added to the acidity of the raindrops, and stored in the ground where, alu-minum is released with disastrons effects on the development of fine roots.

The funrth article in chapter 3 deals with the effects of atmuspheric pollutants on male rials and on research uceds. The author (R. W. Lanting, TNO, The Netherlands) underlines the priority which should be giren to studies ut the corrosion of different kinds of materials thue to SOz and NOz and their secondury products. In wet deposition, chloride, hydrogen, and sulfate ions are important. All articles are followed by a good, up-to-

ilate bibliography. L. M. Malet is will the Almospheric Diffusion and Pollution Group of the Royal Meteorological Institute, 1180 Brussels, Belgium.

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Cover. On January 1, 1983, this circular, rotating ice disk formed in a pool at the ice along the inside bank subsequently spex of a sharp bend in Rancho Nuevo Creek, Ventura Gounty, Galifornia. The

disk, which had a diameter of about 2 m and an angular velocity of about 0.01 s⁻¹, formed during border-ice growth in overnight air temperatures of about -5°C.
Disks with similar geometry, but inferred to consist of frazil ice, have been infrequently about -10°C. quently observed on freezing streams in notthern North America and Europe (whitten communication, George D. Ashon, U.S. Army Corps of Engineers Cold Regions Research and Engineering Labo-

The photo's submitters hypothesize that formation of the disk commenced with entrapment of a small, border ice fragment In an eddy near the inside bank of the expanding channel bend. Growth of border

shifted the eddy position and ice disk to-ward the outside bank, and the size of the eddy and disk may have simultaneously increased. As border ice continued to grow from the banks and covered the downstream portion of the pool, it nearly enclosed the growing ice disk. Counter-clockwise rotation of the disk was pre-served because of the velocity distribution of the flow in the bend. Water motion and ice abrasion caused by the disk's rotation helped preserve a ring of open water around the margins of the disk. (Photograph by Eric Hyolbell, Santa Barbara, California, submitted by Richard Iverson, Department of Applied Earth Science.

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How in apply:
Applicants should submin a letter of intent, a conficultion vhac, and three letters of recommendation. The letter of intent should include a statement of why the fellowship is desired, how you qualify for it, what issues and congressional situations interest you, what cole you envision as a congressional at-ence fellow, and what outcome you hope for in relation to career goals. The individuals from whome you request letters of recommendation should alseems your professional competence and other aspects of your background that make you particularly qualified to serve as a Cangressional Science Fellow. ment is available at the Atmospheric Sciences has search Center.

The ASRC seeks a staff mamber whose research interests are in the application of boundary layer or mesoscale meteorology to cloud and fog processes. The successful applicant must have a Ph.D. and must have a proven potential as a researcher, i.e., publications and successful research grant(s).

Send your application to: Department MP, Cam-gressional Science Fellowship, American Georghysi-cal Union, 2000 Florida Avenue, NAV, 20009, Application deadline: March 31, 1984.

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E102583

Glimatologist-Posidoctoral Research Scientist Lamont-Doherty Geological Observatory of Columbia University. Individual should be interested in climatic variations over the past several centuries. Tree-ring data and climatic reconstructions are available or nuclee development for assembling into areal studies and analyses of climate dynamics. The long-term data is to be used in studying various forting pitenumena and regional variations. Experience in data analysis and knowledge of programing in FORTRAN and BASIC will be extremely useful Applicant should have a strong commitment to research and anticipate being involved in preparation of papers and purquisals.

Send letter of application, resume and names of at least three references by 10 January 1988 to:

Gurdin C. Jacoby
Tree-Ring Laboratory
Lamme-Duberty Geological Observatory
Palisades, New York 19964
Position is a nuc-year appointment with position

ctoud-year renewal. Calumida University is an afarman a sec-

Hydrogeologis/University of Illionis at Urbana-Champalgn. The Department of Geology bas reinstituted its search fire a hydrogeologis to fill a permanent, tenure-track faculty position. The appollution will be at the Assimat Professor level. Salary is inegotiable. A Pla.D. is required. Starting date will be Angust 21, 1984. The successful candidate will have a demonstrated background in one or more of the following areas of hydrogeology: basin unalysis, flow in porous media, or deemical interactions between groundwatee and rock and will be expected to tench one or more graduate courses in hydrogeology, to participate in one undergraduate instructional programs, and to maintain and enhance our existing strong research program in hydrogeology. For equal consideration, application including the names of three referees should be sent by February 1, 1984 to:

Prufessur R. James Kirkpatrick Department of Geology 2-15 Naturni I listory Building 1301 West Green Street Urbana, 11, 61801 Ph. (217) 333-3542

The University of Illinois is an Affirmative Action/Equal Opportunity Employer.

palrecalty of Washington/Paleontology/Paleoblology Geochemistry. The Department of Geological Spaces invites applications in the areas of paleon-Sence tavics apparatum in the areas of pater alogipaleabiology and geochemistry tespecially senents or isotope geochemistry). We are interest in candidates who will establish exceptional are ed in conditates with waterstands executional and insordive research programs. Postdoctoral research especiace is highly destrable. One opening is available beginning September 1984. This is a tenure-war position at the rank of Assistant Professor or higher under executional circumstances. A second position may be available in September 1985. A paraphorist paleobiologist may seek a toint appositupossion may be available in act permiser 1989. A par-kontologist paleobiologist may seek a joint appoint-nean with the Burke Museum on campus. A suc-cessid candidate in either area will be expected to such at both the undergraduate and graduate lev-

di.
Applicant should send vitae and names of four reference to John B. Adams, Chairman, Department of Geological Sciences, AJ-20, University of Washington, Scanle, Washington 98195. Clusting late for applications is February 15, 1984. The University of Washington Is an Affirmative Action/Equal Opportunity Employer.

University of Georgia/12-month tenure-track faculty psoclaiment in the School of Forest Resources. Qualifications: Ph.D in hydrology or forest hydrology with at least one degree in furest resources. Butground should include forest resource management and quantitative sciences. Responsibilities: Teach undergraduate and graduate fevel courses in forest hydrology and watershed management. Perfor a research program in an appropriate area of facil hydrology. Rank: Assistant or Associate Program commensurate with trailing and experience. Pusihaor, commensurate with quantitations. Adaptic Commensurate with training and experience. Posi-tion available: July, 1984. Applications: All applica-tions must be postmarked no later dian. I February 1984. Submit returne, transcripts, and names of at less three references to:

Klaus Steinbeck, Chairman Hydrologist Search Committee School of Forest Resources

University of Washlogton/Faculty Position to Geo-physics. The Geophysics Program at the Univer-sity of Washington invites applications for a tenure-track position. The successful caudidate will be ex-pected to teach courses at the senior and graduate sadem level and to establish innovative, forward-looking research programs. Applicants with a Pfi.D. and evidence of outstanding potential in lastic re-search in any subfield of solid-earth geophysics will be considered. However, applicants with prime in-ters in studying global seismology or in studying the physical properties of the earth's manule and for latters of reference should be sent prior to 31 January 1984 to:

Professor Ronald T. Merrill Chairman, Recruitment Committee Geophysics Program A K-50 University of Washington Neuric, Washington Neuric, WA 196195 University of Washington is an attimated The University of Washington is an affirmative activities opportunity employer.

University of California, San Diago/Assistant Research Chemist. The Institute of Marine Resources at the Scripps Institution of Oceanography, University of California San Diego, anticipates an opening for an ASSISTANT RESEARCH CHEMIST (salary range: \$22,900-\$26,800) in the Food Chain Research Group. The primary responsibility of the position is to carry out fundamental research in marine reganic chemistry in association with other IMR oceanographers.

Applicates must have (a) a Ph.D. in organic chemistry, marine chemistry or chemical accanography, and at feast two years of post-doctoral experience in marine chemistry; iii) an ability to carry out independent research in the ocean as demonstrated by an active publication retord in refereed journals; and (iii) experience in work at sea with modern sampling and analytical methods.

Send resume and mance of three referees by March 1, 1984, 60:

March 1, 1984, 10

Dr. Fred N. Spieas, Director
Institute of Marine Resources, A-028
Scripps Institution of Oceanography
University of California San Diego
La Jolla, California San Diego is an
equal opportunity/affirmative artion employer.

Mionesots Pollution Control Acadamy/Hydrolo-giat. Applications are being accepted for a hydrol-ogist position with the Minnesota Pollution Control Agency. The varancy is in the metropolitan Minne-Ageiry. The varatey is in the metropolitan Minne-apoliv's Paul area. Applicants must have a back-ground in geology, Individogy or engineering with specific tron sework and/or experience in ground water Individuge. A Master's degree may be substi-nated for a portion of the experience rating. Experi-ence in comp and evaluating ground water models is desired. The position will include limited field work and contrastor supervision, for substitution in work and contractor supervision. For application in-formation please contact:

Richard Nelson Minnesota Pollution Found Agency 1935 West Fourity Road II-2 Rosecille, Minteoda 55 [13 Felephone: #512] 296-7761 The State of Minnesota is an equal opportunity

University of towa/Faculty Positions. The Defartment of Physics and Astronome anticipates two openings for temire-track assistant professors or cisiting laculty at any level in August 1984. In exceptional cases a term or temired appointment at the associate professor or professor for professor level will be given to an expecimentalist in intermediate or high energy physics. Curtent research interests in the department are radio and optical astronomy and the lollowing specialities in physics: atomic, condensed mater, elementary particle, laser, nuclear, plasma, and space physics. Faculty illuties include undergrathmat and graduate teaching, guidante of research students and personal research interests at the atmosphere and introduced and arrange for three leners of recommentation to be seen to Seatch Commince, Department of Physics and Astronomic, The University of Lowa, Lowa City, LA 52242.

The University of Lowa is an equal opportunity/ affirmative action compliager.

Synoptic Mateorologist/Flortda Stata University.
The Dept. of Meteorology expects to appoint an Assistant Professor in 1984. This is a tenure-earning position and requires the Ph.D. Degree. Candidates with some just-dot toral experiente will be favored but all qualified candidates are enrouraged to apply. The appointee will be expected to teach; to develop an active research program and to prefetations. The appointee will be expected to teach; to develop an active research program and to partiripate in the governance of the department. Applicants should send comprehensive resumes; including a lim of publications and the mames and addresses of three (3) professional references; to Prof. Jesse J. Stephens, Chaironan; Department of Meteorology; Florida State University; Tallahassre, Florida 32306. The last date for receipt of applications is March 1 1984.

Florida State University is an Equal Opportunity Affirmative Artion Employer and invites applita-tions from all qualified cardidates.

Arizona State University/Postdoctoral Research Aszociate. Thermodynamics of phase transitions, solid solutions, order-disorder, glasses and melts. Prof. A. Navrosky, Dept. of Chemistry, Arizona State Univ., Tempe, A7 85287. (602) 965-4241. Adizona State University is an Equal Opportunity/ Affirmative Action Employer.

Tarlaton State University/Associate Ofrector—Hydrology. Part of the Texas A&M Statem, is offering a B.St. Degree in Hydrology as of the Fall, 1983 Semester. This is the only such degree in the State of Texas. The Associate Director we are seeking must be an enthusiastic indicidual able in work with the Director in sharing the admitustratice local, and developing this magrant ions regimed mal variety of the Director in sharing the administrative local, and developing this program into regional and maintal prominence. This will be a tenure-track appointment, rank and salary negotiable, Ph.D. required. Substantial funding available for facilities construction. Applications are sought from outstanding hydrotoxicologists. Applicants should send resume and names of three references by February I. 1981, to Dr. Roger HyWiest, Phrestor of Hydrology, P.O. Roy, 1-49, Tarleton Samon. Stephenville, Texas 76402. Telephone 817-968-986 (1981) Position must be filled as of April 1.

Faileron State University is an afformative action.

University of Miami/Postdoctoral Position in Physicsi Oceanography. Available for ecsearch on the orean-related aspects of climate in collaboration with CIMAS Fellows and using the farilities of RSMAS and XOAA'S Adamir Oceanographic and Meteorological Laboratory. Applicants simulal submit a resume, a statement of research interest and the names of three references to:

Dr. William W. Fivx, Je., Hirector Cooperative Institute for Marine and Atmospheric Studias RSMAS/University of Miand John Land Hilli Rickenbacker Canseway Miami, F1, 33149 An Equal Opportunity/Affirmative Action Em-

University of South Carolina/Tanure-Track Positions in Geology. The Department of Geology invites applications for two anticipant temore-track positions in two of the following areas: [Geophysics; 29 Ignerus Petrology/Structure; 3] Coastal Processes; or 4) Organir Sedimenta. It is amilcipated that the appointments will be at the assistant professor leval, but applications from more senine persons will also be given strong consideration. A Ph.D. degree is required. Starting date will be August, 1984, will am application deadline of I March 1984. Applicants should send cutriculum vitae, statement of research interests, pertinent reprints, and the names of three references to: Dr. Hjorn Kjerfve, Department of Geology, University of South Carolina, Culumbia, S.C. 29208 (Phone 803-777-4529).

The University of South Carolina is an Equal Opportunity Employee which encourages applicants from qualified minority groups and women.

Atmospheric Scientia/University of Medicin Acceptains

Atmospheric Scientia/University of Vieginia. Ap-plications for a termine track assistant professorship are sought. We wish to strengthen research i apalohi-ties dealing with interactions which occur in the hy-dro-binsphere including shounced transports and transformations. A Ph.D. in mentiorality of a rhose-ic related discipline, a commitment to basic re-tearth, and an interest in working in an interelist-plinary department are required. Applications of from women and ethnic minorities are welcomed. A resu-me, brief scattenent of rewards interests and matues of three individuals who may be contacted for refer-ences should be sent to G. M. Hormberger, Chair-man, Department of Environmental Sciences, Clark Itali, University of Virginia, Charlottesville, Virginia 22003.

The University of Virginia is an Equal Opporto-nity/Affirmative Action Employer. STUGENT OPPORTUNITIES

GRADUATE STUDENT NASA TRAINEESHIPS

NASA TRAINEESTIPS
The Hords State University is acciding applications from prospective graduate students for participation in its NASA sponsored Traineeship Program of Ceranographic Remote Sensing Techniques and Physics of Air-Sea uneraction. The stipend for the colerabit year is \$10,000, Students may be enrolled for a degree of other colerabit and in the colerabit was a \$10,000. for a degree in either occanography or mercorology. For further information or application, please

Dr. James J. (O'Brien NASA Trainership Program Meteorology Armes The Florida State University Tallabasser, Florida 3230b

Announcements

Groundwater Pollution

Aseminar on "Degradation, Reference, and Dispersion of Pollutatus in Grundwater" will belied in Copenhager, Detumork, September 12-14, 1984, by the International Associ-sion on Water Pollution Research and Ganbol Those wilding to participate are usked to abma materials electroneoting their research in the field of groundwater process mechations by February 1. Seminar participants Mhave the option of presculbig original pagen at the meeting or distributing copies of item publications.

The seminar will consider degradation and retention of organic substances, retention of tace metals and inorganic americians, and dispersion processes. For more information, untag Erik Arvin, Dept of Environmental bigineering, Building 115G, Technical Univ. of Denmark, DK-2800 Lyngby, Denmark.

South African Water

The National Water Well Association national conference and exhibition on the development or management of ground-site supplies who would like to participate at asked to submit abstracts by March 16,

tument, waste disposal, and irrigotion.

histon, Oli 45085 (telephone 614-846-

nd the Borehole Water Associaon of Southern Africa will sponsor an luter-South Africa" in Johannesburg, South Africa, weember 12-17, 1984. Three days of the unference (November 13-15) will be devoted to scientific sessions, and those working in

The purpose of the conference is to help impose current groundwater technologies b South Africa, Sessions on groundwater maggement, quality, exploration, and development will focus on state-of-the-art technology in the state of th of including water well construction, water There also will be an equipment exhibition and display during the conference,
Abstracts should be no longer than 250 moracts should be no longer than 200-fewrds, and should be accompanied by a start (an longer than 100 words) biographi-id it will be more in formation, contact Da-M. Micken, Conference Coordinator, MWA, 500 W. Wilson Bridge Rd., Working Conference Coordinator, Mark, 500 W. Wilson Bridge Rd., Working Co., 2014, 846-

Meeting Report

Solar Irradiance **Variations**

The planned repair in orbit by NASA of the Solar Maximum Mission (SMM) in April 1084 provides an excellent opportunity for improved observations of the sun. In retrospect the solar-terrestrial research community should have organized new programs before the 1980 lanuch of this satellite, but foresight ls sometimes difficult to achieve. We now have an opportunity to redress this omission, and the organizers of the June 1983 Workshop on Solar Irradiance Variations on Aclive-Region Time Scales hope that with this ativantage a substantial improvement can be

The goal of the workshop, held in Pasadena, Calif., was to belp plan for improved so-lar synoptic observations to coincide with the 1984 repair of the SMM satellite. Most of the major participants in experimentation, observation, and data analysis were present. A parlicularly important aspect of the meeting was the participation of the ultraviolet (UV)-irradiance community, and it was generally recognized that irradiance variations in the UV are Important both energetically and physi-

Two rather surprising facts surfaced during the workshop. First, although sunspot areas os measured by various observatories generally agree within a few percent, on some occasions very large discrepancies can occur. Second, there is little agreement on the limb-darkening function of faculae. Both of these uncertainties are in classical areas of solar asmy, and modern lechnology can certainly provide an order-of-magnitude Improvement. For example, n better calibration of Co plage areas in terms of facular signal i now becoming available; this calibration can't really be used effectively until quantitative Capage data can aystematically be obtained. New observing programs, new uses of old data sets, and new types of data (e.g., the synoptic 10830 data) all were the subject of vig-

orous discussion.... The modern-dov study of solar total uradinnce variations can be said to really have begun In: 1980, when the first lugh-quality, data became available from the ACRIM gaper-ment aboard the SMM. These data have suf-

licient reproducibility and time coverage to permit observations of "solar constant" variations on time scales from a few minutes to days and weeks; on the longest time scales there appears to be no detectable instrumental drift, but detailed study and cross-calibration will be informative-both ACRIM and the ERB sensor on Nimbus-7 show a consistent downward trend, estimated by Willson to be on the order of 0.04% per year; this trend bad not shown any solar-cycle dependence as

of the time of the workshop. Solar active regions exhibit the bulk of their growth and decay on time scales between a few hours and a few months. The unspots in particular provide a clear signature in the SMM total irradiance data. The identification and measurement of other contributors to the solar variability has been the subject of several modeling efforts, wherein solar synoptic data are used to generate an

artificial time series that can be compared with the solar signal itself. There are two basic ubjectives of such asodeling: the first is at understand the importance of the causes of variation, and through their study to learn about the dynamics of the solar intecior. The second major objective is to provide a de-scriptive "explanation" of the variance. The residuals between such a litted model and the solar data can then be used to search for more subde effects, such as a solar-cycle dependence associated with the quiet sun.

The ultraviolet irradiance variations play a pacticularly important role in understanding the total solur irradiance. Although still controversial, the UV modeling appears to require the need for a third component in addition to the inclusion of sunspots and plage regions. This dired component would physi-

Meatings (coat. on p. 982)

Plan

The AGU Chapman Conference on Natural Variations in Carbon Dioxide and the Carbon Cycle

Convenors: E. T. Sundquist and W. S. Broecker January 9-13, 1983 Innisbrook Tarpon Springs, Florida

Netural Variations in Carbon Dioxide and the Carbon Cycle will bring together eologists who are atudying various sepecte of cerbon cycle history; geochemical modelers; and biologists, oceanographers, and meteorologists who are femiliar with present and potential future relationships among the carbon cycla, otmospheric CO2 and climate.

Questions to be discussed at this conference are: What were the causes of carbon cycle vadetions? How were thay related to atmospharic CO2? Wore they associated with climate changes consistent with the CO2/climata prodictive models? What are the long-term geochemical implications of fossil fuel CO2?

The meeting will emphasize the geologic record, and will include overviewe by experts on the application of ocean modeling, climate modeling, end the bloaphare modeling to CO2 as well as sessions emphasizing the geological record. Presentations will be organized around six time alices: the last 2,000 years, the last

20,000 years, the last 2 million years, the Cenozoic, the Phanerozoic, and the Precambrian. Don't mise this exciting program! Registration and housing information will be available by November 30. To be placed on a mailing list write: CO2 Meeting, 2000 Florida Avenua, N.W., Washington, OC 20009 (202) 462-6903.

For program information contact: E. T. Sundquist, U.S. Geological Survay, 431-National Cenier, Reston, VA 22092 (703) 860-6083.

Short Courses

April 30 to May 4, 1984

Field Methods in

Dr. G. Garland Lala ARSC—Earth Science 324 State University of New York at Albany 1400 Washington Avenue Albany, New York 12222 An Equal Opportunity Employer.

Faculty Position/Northwestacn University. Professor Geological Sciences. Duties include teaching introductory and advanced courses in Geology, Geochemistry, Petrology, and Mineralogy; research in experimental petrology; graduate student advising; recruitment and other administrative duties. Earned doctorate in Geological Sciences, postdoctoral study and minimum. 3 to 5 years expensive required. Extensive knowledge of high pressure experimental research and the application of chemical thermodynamics to geology essantial. 9 month salary \$34,000, Applicants must submit c.v. by January 15, 1984 to:

Seymour O. Schlangar, Chairman
Department of Geological Sciances
Nonhwestern University
Evansion, (L. 6020)
Nonhwestern University is an equal opportunity/
Offirmative action employer.

Atmospharic Sciences Research Cooter/Staff Member. A position up to a three-year term appointment is available at the Almospheric Sciences Research Cooperation

Groundwater Research Institute University of Waterloo

Contaminant Hydrogeology Hydrogeology May 9 to 11, 1984

This course acqueints the practising hydrogeologisi or engineer with current field igation lechniques for the study of groundwater contamination. The focus is on design and implementation of field programmes for the monitoring of parameters needed in water quality evalue tions and environmental impact predictions. Monitoring problems and techniques specific to organic or toxic inorganic contaminants are considered. The course includes extensive field deistrations conducted et an abandoned landfill where numerous techniques have been evalueted during the monitoring of e large pluma of contaminated groundwalar, The course is now in its fifth year.

Environmental Isotopes in

This course presents the state of the ert in isotope hydrogeology and acquaints the its application to hydrogeological problems. In particular, the techniques, and their application and limitations are stressed. Topics include basic lheory end principles, technique using stable isotopes of hydrogen, oxygen, carbon, sulphur end nitrogen and techniques employing naturally-occurring redioactive isotopes. especially tritium end carbon -14. Novel, experimental techniques will elso be criti-

Contaminant Hydrogeology May 28 to June 1, 1984

The course acquaints the practising hydrogeologists or engineer with the state of the art in contaminant hydrogeology. To pics covered include basic physical and chemical principles, the processes that control the behaviour of organic and inorganic conia minants in groundwater, and investigative as well as enalytical tools in the areas of mathematical modeling, laboratory lechniques, and field lechniques, including recently-daveloped approaches. Various types of groundwater contamination problems are flustrated. Ihrough case histories selected from research and consulting projects. Emphasis is on bridging the gaps between theory, the laboratory, and the field, and between research and practice.

For more Information please contact: Healther Sokoloskie or Marilyn Bisgould

practising hydrogeologisi or engineer with cally discussed, Practical applications are stressed with numerous case histories selected from consulting and research pro-

Groundwater Research Institute, University of Waterloo Waterloo Ontario, Canada (N2L 9G1) Telephona (519) 885-1211, Ext. 2892

Meetings (cont. from p. 987)

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cally be irlentified with the "active network" omside the normal active-region boundaries on the sun. Because of its broad spatial extent, this component would not have a large modulation by the solar rotation. The need for such a term is lairly obvious from the UV or HeII 10830 time sequences, but it is unknown (and fundamentally important for solar physics) whether or not this component can be physically distinguished from the evolution of active regions, including the ephemeral regions.

A major goal of the workshop was the identification of ground-based observations that could best provide the key solar symptic data for the interpretation of all these phenomena. In the past, solar synoptic data have not enjoyed the glamor of a number of other branches of astronomy, and this has caused suffering both in terms of resources available and, at times, in quality of personnel. There have been many (probable unfair) references to 17th-century techniques for existing synoptie ilata, but all workshop participants would agree that improvements in type or quality of data are relatively easy to achieve.

This meeting report was prepared by Hugh S. Hudson, who is with the Center for Atmospheric and Space Sciences, University of California Sun-Diego, La Jolla, CA 92093.

Large-Scale Snow

A workshop on Large-Scale Sunw Studies, sponsored by the IAHS International Committee on Snow and Io. (ICSI) was held in Hamburg on August 26, 1983 in discuss a 1981 ICSI working group report on the sulject, present several invited review papers, and obtain recommendations that would be considered for sulmission to ICSI. Albert Rango, U.S. correspondent for ICSI, was the workshop emivenor.

The consensus of opinion at the norkshop was that continued research in remote sensing of snowpack properties should be supported; microwave research should point toward definition of the optimism set of sensors for spaceborne studies; and a comparison of the mapping of large-scale snow extent with

operational NOAA visible products and spaceborne microwave radiometers should be and acted

ICSI should promote the irlea of increased reporting of snow data to the appropriate World Data Centers (WDC) by member conntries. There are few regular countilmous of snow data to the centers whereas data on sea ice is reported much more regularly and in for greater quantity. Improved access to our rentional snow data is manulatory for successlal remote sensing starlies. Furthermore, remore sensing data sets should be submitted to the WDC upon completion of analysis so that they will be available to other investigators, It was pointed out that the U.S. Air Force will lannels another in their series of DMSP satellites in 2-3 years that will carry a multispectral micoware radiometer directly applicable to snow property mapping. ICSI should support the acquisition and archiving of these data so that they can be readily accessible for scientific investigation. This activity must be initiated soon in order to make effective use of the data when the satellite is launched.

The working group will continue to evaluare progress in this area and shall inform ICSI on the likelihood of conducting a sym-

Future AGU Meetings Foll Meetings

Dec. 3-7, 1084, San Francisco (Abstrarts due mid-September 1984) Dec. 9-13, 1985, San Francisco (Abstracts thre mid-September 1983) Ocean Sciences Mosting Feb. 211-24, 1981, New Orleans Spring Meetings

& SUN Report

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anography: ad noting IAPSO Resolution too. 9 adopted in

IAPSO wekomes Part Two of the SUN Remon:

onemaky to study the report and consider its use because publishers, and editors of oreano-

and recommends the adoption of the complete of Report in final form and urges the scientific

raphic journals, hopefully by January 1, 1986.

1. Atmospheric and oceanic observations

Recognizing that the World Climate Research

hogsin requires amouspheric and or carde observa-person requires amount that termination of Ocean Senso PAPA in the North Pacific in 1981 consti-

me a serious loss to the climath record, to attou-

ghere and oceanic research activities, and to oper-simal weather forecasting;

agention, weather ships raintent be relied on no ponde continuous, fixed point observations, and baunder Canadian leadership, several North Pa-

dentions are cooperating in new ship-of-oppose-

nexy programs to provide oceanographic, surface percological, and upper air observations; behresolved that the IAMAP, IAPSO, and

IVG commend the efforts of Canarla by prodertak-

is to develop a satisfactory ship-of-compositions; oh-

mogning further the increasing importance of suffice to oceanographic and anecescobagical ob-

rather smellites over ocean areas be orgest to take

The first distinguished service award that

UPSO has ever given to a physical occanog-upher, entitled the "Hard Work Award" and oussing of an inlaid Indian jewel hox, was

gien to Maurice Menaché, formerly with the

issitu Océanographique in Paris, for his 111 par of distinguished and devoted service as

hairman of the IAPSO Working Group in

Spice International (SI) muits in physical

international Association

of Seismology and Physics

editions are un important barometer of

ad can be a powerful tool in the develop-

nate programs, however, unity if they at e red Carried back home by the makental

manitees which make up the HIGG, the

solutions can spread information worldwide

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Bung will present the resolutions before de-bersite hodies and otherwise use them in

tale decision makers aware cil international

The 19 resolutions adopted by HIGG as a

ole appeared in Eas, October 4, 1983, p.

e International Association of Scismulogy

of Physics of the Earth's Interior (IASPEI),

Recognizing the languarance of historical sels-tone to the study of seismichy, earthquake risk, of the mechanism of earthquakes, particularly the bree statement of the languages.

where few records are available are

commends the progress of the joint 1A-seco Working Group on Historical Seismo-

ocating and copying historical materials,

in Unexo in supporting and extending the of the Group, and urges all seismologists and tested bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of the recommendation of he detailed bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of he detailed bodies to study and act upon the recommendation of the recommendat

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no meteocological and oceanographic clara.

Aneps to insure the continuity and qua

Direct to National Committees

"Hard Work Award"

lineed to National Committees

wer the Pacific Ocean

position on large-scale effects of snow at ether Budapest (1986) or Vancouver (1987). Such assice must be provided two yearsis

May 14-18, 1984, Cincinnad (Abstracts due February 22, 1984)

May 27-31, 1985, Ballimore (Abinacts the early March 1985)

This succeing report was contributed by Alben Rango, who is with the U.S. Department of Squ-culture's Agricultural Research Service, Behall,

Actions at Hamburg

International Association for the Physical Sciences of the Ocean

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Henry Charnock (UK)

Joint ICES/IAPSO/ECOR/UNESCO Panel of Experts on Oceanographic Tables and Standards

N. P. Fofonoff (USA), A. Poisson [France]

Resolutions

Reproduced below are resolutions adopted by IAPSO during the 18th General Assembly of the International Union of Geodesy and Geophysics (IUGG) in Hamburg, August 15-

The resolutions passed at each quadrennial general assembly of IUGG and of its member associations are an important barometer of eurrent opinion in the geophysics community and can be a puwerful tool in the developntent of the scientific programs to which they are addressed. The resolutions will help advance programs, however, only if they are used. Carried back home by the national committees which make up the IUGG, the resolutions can spread information worldwide on programs that promise to most effectively advance geophysical knowledge. IUGG and its member associations intend that member groups will present the resolutions before de-liberative bodies and otherwise the them to make decision makers aware of international

scientific thought.

The 19 resolutions adopted by LUGG as a whole appeared in Eas. October 4, 1983, p.

1. Satelllie and land-based remote sensing Noting the great potential of satellite-borne sensors for making a variety of critical oreanographic measurements on a global scale, as demonstrated for example, by Seasat:

noting that plans for some future organographic satellites have been deferted or dropped; and noting the similarly great potential of land-based remote sensing for studies of coastal and

near-shore oceanog raphy; IAPSO recommends that nations with capabilities in these areae support them generoosly and that in order to obtain maximom scientific benefit from these systems or anographers be fully involved in decisions about system capabilities starting at the earliest stages of planning. Directed to National Committees

2. Oceanographic tables and manual

Noting the occanographic tables being postuced by the JPOTS subpanel: and realizing the need for an additional manual

consisting of tables, procedures and techniques of physical oceanographic computations, especially for those scientists who the not have smaller computers. and for use in reaching practical necamographic IAPSO recommends that UNFSCO and SCOR be

approached to form a working IAPSO to address this matter. roached to form a working group together with Directed to UNESCO and SCOR

3. Oll disaster in the Arabian Gulf Noting the community discharge of crude oil into the sea from war-destroyed nil wells into the Arabi-

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TECTONICS AND

MAGMATISM (1979)

Edited by R. E. Riecker

RIFT:

REUCIAL

an Gulf for many months being a fast-growing perl to the fragile habitat in the Golf; moting the increasing concern of marine scientist all over the world about the consequences of this

and noting that no accempts so far have led to a solution of the problem; IAPSO recommends that all scientists be called npan 6) promote and support efforts to end this si-nation as sean as passible.

4. Tidal measurements

Recognizing the need for improved models of the ocean tirles, buth for their intrinsic importance and their applications to geodetic, satellite, and electro

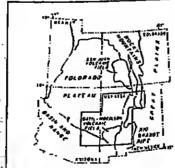
magnetic measurements; IAPSO recommends that additional literal and pelagic titlal measurements be made, especially in areas where present mealths differ or where few measurements have been taken, and also in shelf seas where the tidal dissipation rate needs to be more accurately determine Directed to National Committees

5. Algorithms for occanographic computations

of the Earth's Interior Common applies I ables and Standards IAPSO adopts for general use by oceanographer. Resolutions the Algorithms for Oceanographic Computations as designed by N. P. Fofonoff and R. C. Millard:

Reproduced below are resolutions adopted mid IAPSO urger UNESCO to publish these algo-ASPEI during the 18th General Assembly rithing as some as possible. the International Union of Geralesy and Directed to UNESCO Gophysics (IUGG) in Hamburg, August 15-

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10 8 13

Geologic map of the Rio Grands Rifl and Southeastern Colorado Plateau, New Mexico, and Arizona

the large earthquakes or amalier strocks occurring angles of infrequent activity or in developing senior when the company and the company of cour or in detailed report, in particular mose that to the preservation of original selumosa, the immediate copylog of the records of particular and carthquakes, the documentation detailed that no longer exist, and the return of the food of their country of origin.

etognizing the dramatic progress at the de-au of sarthquake algorithms, and that the parameters used to characterize the seismic has godually expanded and that many of the parameters can how be routherly estimat-inguing the need for botter algorithmid the meet for botter algorithmid. king the need for belier under

its awaing die need for better understanding is estate of all bate carthquake parameters. Said in the state of all bate carthquake parameters. Said is important to exchange algorithms in seedal knowledge of important algorithms be an algorithm of the completion and distribution as part in the bate of the production and distribution as part.

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3. Recognizing the need to checidate and resolve details of lithospheric structure, and noting that recent marine seismic reflection surveys of a tonventional kind have disclosed at panderate cost such de tails to depths of 15 to 50 km beneath continental diefres, arges the international organization of co-operative survers not only in shelf areas, but also be alland seas and lakes as well as on land. The shelf seas and continental margins of Europe, shield areas, and collision zones such as the Mediterranear and recognizing that as a result of increasing cost and Southeast Asia are examples of suitable places to unplertake such similer.

- d. Noting that research related in earthquake prediction is moving from the stage of gathering lata to that of testing hypotheses, and recogni that it is important to develop comprehensive meoxis for formulating and evaluating earthquake predictions, resolves to seek the cooperation of Unesco and other international bodies in organizing an international seminar on "Testing Hepotheses of Farthquake Prediction."
- 5. Recognizing the value of the work performed by the Standard Earth Modal Committee, and not-ing their conclusion that further refinement of the Model is necessary, thanks diess for their work in creating the Preliminary Reference Earth Model, and residies to continue in support within the Transework of the Commission on Seismological
- 7 Noting that the lack of aufficient strong-mo-tion data hampers the understanding of the nearsource effects of earthquakes and the behavior of structures, arges that efforts to collect such data be

ii. Reallithing the importance of standardizing trong motion records succeed in resolution 9 of its

[58] Assemble, residees to spousor an international

workship to compate and exchange current proc-

- Oceanography, TAPSO Secretary General En-gue C. LaFond notes that Memoché "stead-haly guided the successful establishment of 8 Priges the World Data Penter, in collaboranon with IAEF and other interested organization to errounage and intensity the collection and distribution of strong-motion data.
 - Noting the importance of a lufter theoretical and open cational understanding of the nonlinest behavior of soils subjected to strong earthquake motion, urger seismologius to install lurther instru ments in borcholes, and three-dimensional arrays, and because our such studies.
- 10. Recognizing the importance of collecting, processing, and publishing high-quality schoological data on a global scale connected the International Selsmulogleal Center most highly for ite continuing achievements in this lield, and expresses its slucery thanks to the director and staff for their sub-The resolutions passed at each quadrennial meral assembly of IUliG and of its member stantial crum ibution to the Association by their support of the IASPEI Secretariat. anea opinion in the geophysics rountunity near of the scientific programs to which they acaddressed. The resultations will help art-
 - 11. Lamblering the success of the 1985 Assembly, and recognizing the effort and time that usary people have expended in its preparation, expresses its thanks to all who have in any way contributed to that anores. It arknowledges his particular indebted ness to the Local Organizing Ponuminee.

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Aeronomy

0430 Composition latomic or octaculart
THE ZOMALLY EVERAUED IGROUATION, TEMPERATURE, AND
COMPOSITIONAL STRUCTURE OF THE LOWER THERMOSPHERE AND
VARIATIONS WITH GEOMETRIC ACTIVITY
B.G. Robis (Mational Center for Almospheric Research*,
F.D. Box 3000, Boulder, Colorado 80107) and J.F.
haceing

P.O. Box 1900, Soulder, Coloredo 80107) and J.F. haeing A sonally averaged chemical-dynamical model of the thermosphero is used to essaine the effect of high-lactuide perticle sed Joule heating on the neutral composition, temperature, and wieds at solution lor solar minimum conditions. The peridional circulation forced by solar beacing slone is a surcer-to-winter flow, with a winter enhancement in stocic coryen. The bigh-lactuide heat sources drive seam circulation cells ther relations had solar-driven circulation in the sames heatsphere and oppose this circulation in the solars had solar-driven before the relative concentration of W and O1 in the high-lactuide heat sources increase the relative concentration of W and O2 in the high-lactuid upper thermosphere and decrease the O concentration in the bigh-lactuide lower thermosphere. Tot prolonged moderate levels of secongantic activity the peak atcold oxygen density in the polar regions can decrease by factorn of 1-3 from secongantic quiet conductions.

J. Geophys. Res., Apace, Papes 3A1753

0430 Composition | Intensit or molecular)
THE 010MAL DISTRIBUTION OF THERMOSMERHI 00D MITHOGEN
FOR SOCSTILS SOMDITIONS DOSING SOLAR CYCLE MINDRON
J.-1. Gérard linacitut d'Marcophymique, Université de
Liège, 4200 (lège, Belgium), 8.0. Robie, 0.W. Rusch and
A.I. Stewart

A-I. Stewart

A two-dissentous model of the minor neutral conscituence K(*DI, MI*3), and MO (row 70 to 180 km is (ormalisted and used to (nevertigate the global distributions of these species for December solutions confitient during solut cycle minimum. For background properties, the monally averaged circulation, temperature, and coopesitous is structure of eagler moveral constituents in the thereoephete are obtained from the coupled dynamical

chemical model cyculations of Roble and Kamting [1983]. Transport of the minor neutral constituents by bosh the neridions (and vertical circulation and vestical polecular and odd) diffusion are considered in the model. The calculated distributions of the ninor neutral constituents for solar lonization only and for solar plus auroral lonization are considered. The results show that the summer-to-winter pole mas] dional circulation transports both FO and Will access the solar forminator into the polar night region where those is a downward, varies! transport toward the mescaphore. The calculated initiation of HO in the lower thermosphers for the solar-lonization-only case does not agree with the intitudinal HO distribution. To obtain agreement between the calculated and observed structure it is measured by the Atmosphere Explorer sorallites. To obtain agreement between the calculated and observed structure it is measured to include contextion end dissociation sources due to surgeral particle precipiacion. The temperature and compositions (armicuses and the circulation changes caused by high-let liude heating and the particle-loduced production of NCO] and William and the particle-loduced production of NCO and Russian and the circulation changes caused by high-let liude heating and the particle-loduced production of NCO and William coefficienc calculated NO attracture Into better agreemens with observations.

The choice of the addy diffusion coefficienc calculation.

observations.

The choice of the eddy diffusion coefficient califically controls the downward flow of the mospheric nicrie on Me lace the mesosphere. The model shows these she odd nicrogen despises at high wincer latisation are emittedly controlled by particle pracipitation and seemspore

processes. J. Geophys. Ess., Space, Paper JA1781

Electromagnetics

0720 Electromagnetic Theory DETENDATION OF A VECTOR POTETIAL Thomas E.S. Senior and David A. Esienaki [Pedlarion Laboralory, The University of Michigan, Ann Arbur M

A verter potential is determined for a state field attributable to sources indused on a perfectly conducting surface B. With the electrostatic problem is in shown that for closed and ogon surfaces existing rethods for the construction of the potential are inconvenient and landquate respectively, and also matter actions are declared in both cases. Plactrimagnetic theory, scattering.

Rad. Sci., Paper 161888

Rad. Sci., Paper 351888

O730 Scattering
ASHATORIC APPROXIMATIONS OF RADJATION INTEGRALS - EMPFOURT AND DOUBES EMPROINT DIFFACTION
IT AND DOUBES EMPROINT DIFFACTION
IT-S. Fildal (Slettron's baserch Laboratory, Morwagian
Institute of Technology, N-7018 Troubbell-With, Morwayi,
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is which the Lategand has a massionary phase point near
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escondary distantion to assum chapted of accordary
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specture afficiencies of dual rediactor ameens and
cylindrical reflector matemas. [OII] raction,
acattetium, raflactor antennas.]

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Volume 88 Number C15 December 20, 1883

Nonurban Troposphare Composition Symposium III. L. Chameides, T. E. Graedel, and R. J. Chameides, T. E. Graedel, and R. J. Chameides (Paper 300815) G. P. Accompd. J. L. Grav. 10:655 Marine Aerosol at Southern Mid-Latitudes (Paper 3C0368) Measurement of Monoterpene Hydrocarbons at Niwot Ridge, Colorado | 1Paper 3C 12341 | J. M. Roberts, F. C. Feltrenfeld, D. L. Albeltron, and R. E. Meters | 10.667 | Alessuement and Modeling of the Concentrations of Terpenes in Conference Services | 10.667 | 1Paper 3C 14541

Oystein Hov. Jorgen Schooldager, and Bente M. Wathne 10,679
The Almosphreir Chemietry of Hydrogen Cyanide (HCN) 1Paper 3C15701 R. J. Cicerone and R. Zeilner

A Model Study of the Effects of intermittoni Loss on Odd Nitrugen Concentrations in the Lower Trapochere 1Paper 3C1995

Richard W. Stewart, Sultan Hameed, and Gregory, Mathell 19,597

Stratospheric-Troposphric Ozone Exchange in Antarctica Caused by Mosmain

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Elmer Robinson, David Clark, Dagmar R. Cronn, W. Lee Bumenberger, and Austin W. Hawan

Kinotics and Mechanism of the Oxidation of StIVI by Ozone in Aqueous Solution With Particular Reference to SO2

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Warren H. White, Unsid E. Pattersoo, and William E. Wilson, Jr 10,745

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George T. Wolff, Nelson A. Kelly, Martin A. Fernon, and Mark L. Marrissay 10,769

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J. A. Ryan and R. O. Lookh 11.005